CLAIMS

What is claimed is:

1. A watermark embedding method based on discrete cosine transformation (DCT) subband image characters to generate a frequency image from an original image using an 8*8-block DCT and to embed a binary watermark image into a subband image of the frequency image, the method comprising the steps of:

setting the values of a first experience parameter TH1 and a second experience parameter TH2;

obtaining the frequency image converted from the original image and a series (A1...An) of the binary watermark image;

extracting in order a 3*3 macro-block of the frequency image and read in order the numerical value An of the binary watermark image; and

analyzing the type of the numerical value being read from the binary watermark image and performing a DCT parameter setting for an embedded block, which further includes the steps of:

computing a plurality of sets of parameter combinations of the embedded block in the 3*3 macro-block and comparing the parameter combinations with the DCT parameter error of the embedded block;

adding the parameter combination with the least error and TH2 to replace a DCT parameter of the subband image position in the embedded block when the least error is less than TH1 and An is one of 1 or 0; and

subtracting TH2 from the parameter combination with the least error to replace a DCT parameter of the subband image position in the embedded block when the least error is less than TH1 and An is the other of 1 or 0.

2. The method of claim 1, wherein the first experience parameter TH1 is set according to required image distortion.

3. The method of claim 1, wherein the second experience parameter TH2 is set according to required image robustness.

4. The method of claim 1, wherein the extraction of the 3*3 macro-block is performed from left to right (two blocks to the right at a time) and from top to bottom (two blocks down at a time).

5. The method of claim 1, wherein the embedded block is the central block Block(2,2) of the 3*3 macro-block.

6. The method of claim 1, wherein the estimation function of the parameter combinations is selected from the group consisting of:

(1) $[Block(1,1)_{D(a,b)}+ Block(1,2)_{D(a,b)}+ Block(1,3)_{D(a,b)}+ Block(2,1)_{D(a,b)}+ Block(2,3)_{D(a,b)}+ Block(3,1)_{D(a,b)}+ Block(3,2)_{D(a,b)}+ Block(3,3)_{D(a,b)}]/8$;

(2) $[Block(1,1)_{D(a,b)}+ Block(3,3)_{D(a,b)}]/2$;

(3) $[Block(1,2)_{D(a,b)}+ Block(3,2)_{D(a,b)}]/2$;

(4) $[Block(2,1)_{D(a,b)}+ Block(2,3)_{D(a,b)}]/2$;

(5) $[Block(1,3)_{D(a,b)}+ Block(3,1)_{D(a,b)}]/2$;

(6) $[(Block(1,1)_{D(a,b)}+ Block(1,2)_{D(a,b)}+ Block(1,3)_{D(a,b)})/3 + (Block(3,1)_{D(a,b)}+ Block(3,2)_{D(a,b)}+ Block(3,3)_{D(a,b)})/3]/2$; and

(7) $[(Block(1,1)_{D(a,b)}+ Block(2,1)_{D(a,b)}+ Block(3,1)_{D(a,b)})/3 + (Block(1,3)_{D(a,b)}+ Block(2,3)_{D(a,b)}+ Block(3,3)_{D(a,b)})/3]/2$;

where Block(1,1), Block(1,2), Block(1,3), Block(2,1), Block(2,3), Block(3,1), Block(3,2), and Block(3,3) represent the 3*3 macro-blocks from left-top to right-bottom,

and $_{D(a,b)}$ is the DCT parameter of the subband image located at the position (a,b).

7. The method of claim 6, wherein a=3 and b=2.

8. The method of claim 6, wherein the subband image position is changed to a=3 and b=3 if the least error of a=3 and b=2 is greater than the first experience parameter TH1.

9. The method of claim 1, wherein adjacent 3*3 macro-blocks allow overlap 1*3 blocks on top/bottom or 3*1 blocks on left/right.

10. A watermark embedding method based on DCT subband image characters to generate a frequency image from an original image using a p*p block DCT and to embed a binary watermark image in a subband image of the frequency image, the method comprising the steps of:

setting the values of a first experience parameter TH1 and a second experience parameter TH2;

obtaining the frequency image converted from the original image and a series (A1...An) of the binary watermark image;

extracting in order a q*q macro-block of the frequency image and read in order the numerical value An of the binary watermark image; and

analyzing the type of the numerical value being read and performing a DCT parameter setting for an embedded block, which further includes the steps of:

computing a plurality of sets of parameter combinations of the embedded block in the q*q macro-block and comparing the parameter combinations with the DCT parameter error of the embedded block;

adding the parameter combination with the least error and TH2 to replace a DCT parameter of the subband image position in the embedded block when the least error is less than TH1 and An is one of 1 or 0; and

subtracting TH2 from the parameter combination with the least error to replace a DCT parameter of the subband image position in the embedded block when the least error is less than TH1 and An is the other of 1 or 0.

11. The method of claim 10, wherein the first experience parameter TH1 is set according to required image distortion.

12. The method of claim 10, wherein the second experience parameter TH2 is set according to required image robustness.

13. The method of claim 10, wherein the extraction of the q*q macro-block is performed from left to right (two blocks to the right at a time) and from top to bottom (two blocks down at a time).

14. The method of claim 10, wherein the embedded block is an arbitrary block Block(i,j) of the q*q macro-block.

15. The method of claim 10, wherein adjacent q*q macro-blocks allow overlap 1*q blocks on top/bottom or q*1 blocks on left/right.